THE CITY OF Kalamazoo

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September 17, 2008

Mr. Michael Berkoff
Remedial Project Manager
Superfund Division, Region V
77 West Jackson Blvd.
SR-6J
Chicago, Illinois 60604

Re: Allied Paper, Inc. Operable Unit Remedial Investigation (RI) Report

Dear Mr. Berkoff

Thank you for the opportunity to review the *Allied Paper, Inc. Operable Unit Remedial Investigation Report*, March 2008. Due to the unique environmental setting of this operable unit, we encourage the continued involvement the City of Kalamazoo, its citizens, and local environmental organizations in the Superfund process to affect an outcome that will truly be protective of human health, welfare and the environment. We look forward to our continued discussions with EPA Region V and MDEQ regarding the Remedial Investigation Report, as well as the development of the Feasibility Study and Remedial Design.

The attached report, *Interim Technical Responses to Allied Paper Operable Unit Kalamazoo, Michigan Remedial Investigation Report, dated March 19, 2008*, presents the interim technical comments for the above-referenced report. The technical comments regarding the RI report were prepared collaboratively by the Kalamazoo Department of Public Services staff and NTH Consultants and are based solely on the information presented in the RI report.

Our evaluation, analysis and subsequent comments are focused on the deficiency of the pathway analysis and subsequent potential threat to the Kalamazoo Water Supply System; the adequacy of the Interim Response Measures; and other deficiencies such as completeness of the site characterization and apparent consideration of use of contaminated waste residuals as part of the final remedial design.

This is an interim evaluation and review. The review of the nearly 10,000 pages of text, data tables and figures continues, and thus additional comments may be generated, particularly as more information is shared concerning the Feasibility Study and Remedial Design. We look forward to submitting future comments as those documents and related reports become available for our review.

Should you have any questions regarding this report, please contact me.

Sincerely,

Michael C. Wetzel, P.E.
Environmental Services Superintendent

enclosure

c: Hon. Mayor Bobby J. Hopewell, City of Kalamazoo
Kenneth P. Collard, City of Kalamazoo
Bruce E. Merchant, City of Kalamazoo
Jeff Spoelstra, Kalamazoo River Watershed Council
Gary Wager, Kalamazoo River Clean-up Coalition
Paul Bucholtz, MDEQ
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Interim Technical Responses to Allied Paper Operable Unit Kalamazoo, Michigan Remedial Investigation Report, dated March 19, 2008

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Prepared For:
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Project No. 13-070773-00
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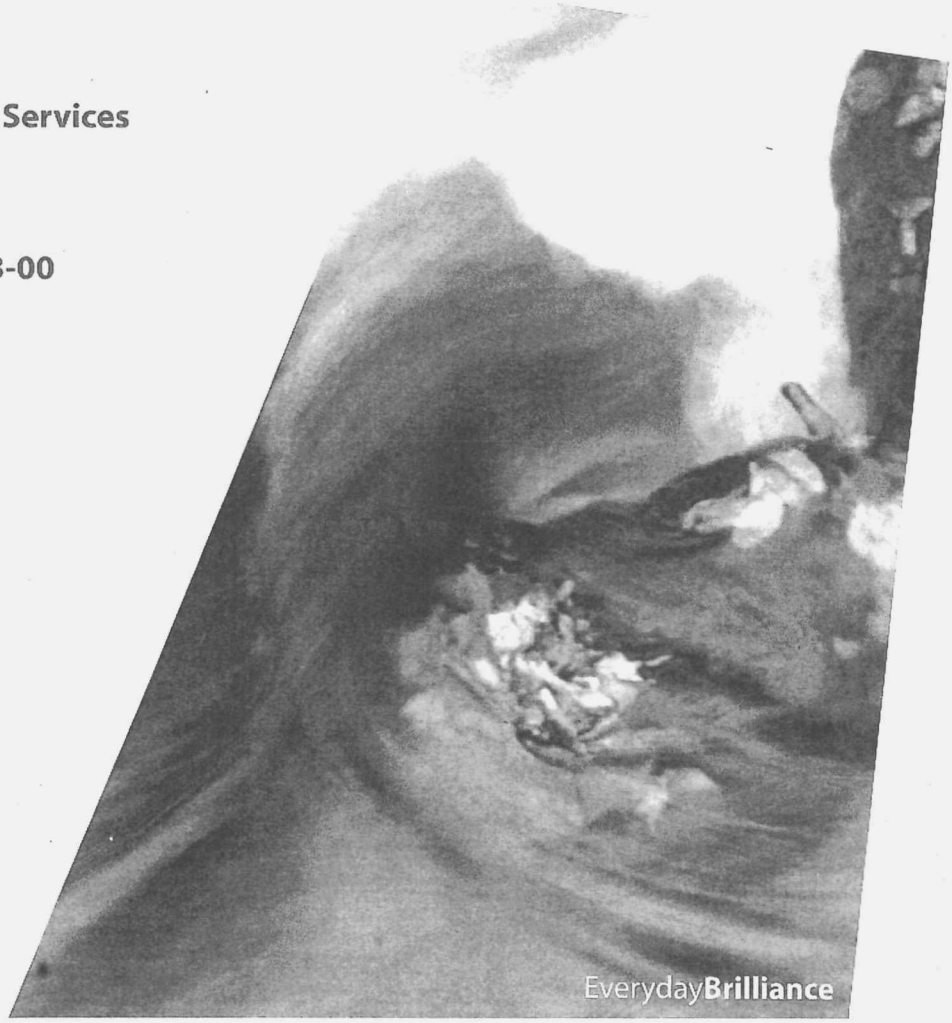

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EXECUTIVE SUMMARY

The attached report presents the interim technical comments regarding the "Allied Paper, Inc. Operable Unit Remedial Investigation Report," dated March 2008, prepared for the Michigan Department of Environmental Quality (MDEQ) by CDM. This remedial investigation report (RI) includes over 9,500 pages of text, figures, and tables prepared over a period spanning nearly two decades.

Technical comments regarding the RI report were prepared collaboratively by the Kalamazoo Department of Environmental Services and NTH Consultants, Ltd on behalf of the City's Department of Public Services. Our comments are based solely on the information presented in the RI report, published under the auspices of the MDEQ and the United States Environmental Protection Agency (EPA), Region V staff.

The focus of our evaluation, analyses, and resulting comments, is the potential threat posed by migration of polychlorinated biphenyls (PCBs), known carcinogens, and other contaminants, identified at the Allied Paper Superfund Site, also known as Operable Unit No.1 (OU-1) to the Kalamazoo water supply system, which depends on a series of wellfields, two of which are located approximately ½ mile from the Allied Paper site. The City's wellfields supply water to approximately 120,000 residential and commercial customers, representing the second largest groundwater based system in Michigan.

Another emphasis of our comments and report is the adequacy of the Interim Response Measures (IRMs) implemented over the past 15 years by the Principally Responsible Party (PRP), currently known as Millennium Holdings, LLC. These IRMs, which include a metal sheetpile wall and groundwater/leachate collection systems, were initially installed to prevent catastrophic failure of material excavated from the former Bryant Mill Pond into the previous residual dewatering lagoons (HRDL/FRDLs) that occupy only approximately one-third of the total OU-1. We did not evaluate other environmental impacts related specifically to surface water quality, biota, or other media; it is anticipated that the Kalamazoo River Clean-Up Coalition and their independent consultants will address these issues in a separate report.

From the onset of our review, we recognized the RI report contradicts the findings and opinions of the PRPs and/or the regulatory agencies. Several examples emphasize this point. Specifically, the agencies contend

that RI is sufficient to move forward with the Feasibility Study (FS), but then admit a bias in spatially sampling that demonstrates the entire site is not fully characterized. Further, the RI includes a patently incongruous proposal, obviously suggested by the PRP's consultant, that contaminated waste residuals are suitable as part of the final remedial action plan. Also, specific to Kalamazoo's main concern, the MDEQ Water Bureau's opinion that OU-1 is a potential threat to the City's water supply system is not even considered in the report, demonstrating a complete lack of intra-departmental communication. Finally, contrary to opinions presented previously, in their conclusions the agencies admit that the IRM measures are ineffective at best and the site is "uncontrolled."

In summary, it is obvious that the RI is deficient in many regards and additional investigation is required to fully characterize the site prior to moving toward the FS stage. If the FS process moves forward without consideration of the deficiencies identified in the RI, Kalamazoo insists, short of complete waste removal, on total containment of OU-1, including a total cut-off barrier, waste consolidation, capping, and additional internal drainage features to create inward gradients, as the primary model for the feasibility study and the ultimate corrective action.

1.0 OVERVIEW

To date, the Remedial Investigation (RI) for Operable Unit-1 (OU-1), which is part of the entire Allied Paper, Inc. /Portage Creek/Kalamazoo River Superfund Site, has been completed by MDEQ and approved by EPA Region V. OU-1 consists of former paper mill residuals and solid waste disposal areas. In late 1999, approximately 146,000 cubic yards (yd^3) of PCB contaminated sediment was excavated out of the Portage Creek floodplain (i.e., the Bryant Mill Pond) and placed in formerly used dewatering lagoons (i.e., the Historical Residual Dewatering Lagoon {HRDL} and the Former Residual Dewatering Lagoons {FRDLs}, as designated in the report) as a Time Critical Removal Action. After being placed in the lagoons, the material was capped using geosynthetics and soil backfill material. The RI was written from data collected from previously installed monitoring wells and well logs on the site, as well as test results from various other environmental media.

OU-1 is now in the Feasibility Study (FS) phase of the Superfund process and there are a number of concerns raised by the City of Kalamazoo and concerned citizen action groups that require the attention of EPA Region V. A number of technical issues were submitted to EPA and MDEQ in 2007. Those technical questions have, largely, gone unanswered. Those comments, along with those generated from the review of the RI report are presented using a general framework that separates the technical issues according to various categories that coincide with the general purpose of an RI. .

2.0 PURPOSE OF REMEDIAL INVESTIGATION

The intended purpose of the RI is to primarily serve as the mechanism for collecting data to:

- Characterize site conditions,
- Determine the nature of the waste, and
- Assess risk to human health and the environment.

In turn, the RI data influences the development of remediation alternatives that will be considered during the FS, which includes clean-up criteria, screening, and a detailed evaluation of alternative remedial action options and technologies.

Therefore, the enclosed comments primarily focus on information relevant to addressing the intended purpose of the RI. Additional comments pertaining to the FS will be submitted when that report has been completed. We anticipate that we will meet with the agencies and, possibly, the responsible parties, to discuss the development of options for site remediation and the assessment of risk to human health and the environment as a preliminary step to the completion of the FS report.

We note that our comments and observations deal primarily with issues related to groundwater flow and quality, particularly in relation to the potential threat to aquifers tapped as the primary water supply for Kalamazoo and the ongoing and future adverse impacts to Portage Creek. We also focus on the performance of the IRMs, specifically the existing barrier wall/groundwater/leachate collection systems.

Generally, issues related to surface water quality and other environmental media are being addressed by the Kalamazoo River Clean-Up Coalition, their independent consultants, as well as other interested citizen groups and stakeholders. We anticipate that these groups will submit a separate report outlining their concerns under separate cover in the near future.

3.0 PRIMARY ISSUES OF CONCERN

In early 2007, concerns arose out of the proposal to continue use of OU-1 for the disposal of PCB contaminated sediment related to another proposed Removal Action in a downstream segment of the Kalamazoo River near Plainwell, Michigan. After considerable opposition and submittal of a number of technical concerns, the EPA modified the disposal decision for the excavated sediment from OU-1 to commercial landfills. Now the focus has shifted to the long-term outcome for the Allied Paper site.

The primary concern is that OU-1 lies within the 5-Year Time of Travel Capture Zone (Capture Zone) for five of Kalamazoo's municipal wellfields (totaling 26 wells) and consequently, presents a potential risk of future impact on the water supply due to contaminant migration toward the wells. Existing soil and groundwater information, presented in the RI report, does not support that all contamination migrating at the disposal site is controlled by the sheet piling system and eventually is treated prior to being discharged into Portage Creek.

The installed sheet pile barrier/groundwater collection system was primarily built to contain contaminated sediment out of the 100-year floodplain of the Portage Creek but has been credited with intercepting the near surface groundwater flow to an on-site pretreatment system that discharges to the Kalamazoo Water Reclamation Plant. In addition, there is sufficient evidence to suggest there is an underflow component that actually leaks through the sheet piling to the Portage Creek, or possibly underneath this significant surface water feature.

Furthermore, the available information does not conclusively support EPA's claim that contamination has not and/or cannot impact deeper saturated zones tapped for the City's water supply. There is a lack of definitive hyrdrogeological data in the RI to determine the flow direction of the deeper regional groundwater at the site. This deeper aquifer is literally not addressed in the report but there is sufficient evidence that a downward groundwater potential exists in at least one location at the site.

Another area of concern pertains to EPA's patterned approach taken for the other landfill operable units that comprise the entire Superfund Site (Willow Blvd/A-Site (OU-2); King Highway Landfill (OU-3); and 12th Street Landfill (OU-4)), and how that approach will potentially be used for the OU-1 that also includes the former Type III landfill, the Western Disposal Area (WDA), and the Monarch HRDLs, all of which contain PCB-impacted residuals. For the other operable units, the Record of Decision (ROD) indicates that the landfills may not be upgraded with engineering controls, as normally required for a landfill where PCB contaminated material has been disposed.

Instead, the EPA Region V Administrator issued a 'waiver' by stating that the current status of the landfills is equivalent to a Toxic Substances Control Act (TSCA) licensed landfill from a perspective of being protective of human health and the environment. If this strategy is applied to OU-1, this determination is not acceptable to the City of Kalamazoo based on the lack of information in other parts of OU-1, conductance of site modifications in the areas of the HRDL and FRDLs to date, and that the site is located within a multi-residential neighborhood area.

4.0 TECHNICAL REVIEW COMMENTS & OBSERVATIONS

This report is an evaluation and review summary of the Allied *Paper, Inc. Operable Unit Remedial Investigation Report*, March 2008. The discussion presented in this report is a compilation of the technical review conducted by Kalamazoo's Environmental Services staff in conjunction with outside consultants experienced with landfill engineering, hydrogeology, CERCLA, TSCA permitting and related issues. Our comments are organized in a manner that is consistent with the intended purpose of the RI.

The issues brought forth and discussed in this report have been organized into the following main divisions:

- Wellhead/Water Supply Protection
- Overall Site Characterization
- Sheet Pile Barrier & Ground Water Collection System
- Geotechnical Implications of PCB Contaminated Residuals in OU-1
- Waste Residuals as Landfill Liner Material
- Considerations for the Feasibility Study

4.1. Wellhead /Water Supply Protection

Our technical review in this category, which has been and remains the City's current primary concern, is based on data presented in the RI, including soil boring /well logs, geologic profiles, groundwater chemistry, water levels, flow nets, and the other analytical tools discussed in the report. In addition, we referenced the MDEQ-approved wellhead protection reports prepared by and/or for the City. Finally, we included the evaluations and comments by the MDEQ's Water Bureau Engineer, Mr. Brant Fischer in an interoffice memorandum dated April 30, 2008 to Mr. Paul Bucholtz of the Superfund Section. This memorandum was not considered in the development in of the RI report.

Our concerns about the information contained and/or omitted in the RI, and some of the assumptions and/or conclusions developed by the agencies, are explained below.

The RI does not include any discussion/evaluation of possible pathways from the operable unit to the municipal wellfield. Although information is presented regarding wells located at the Allied Site, no discussion or evaluation is performed of the possible drinking water pathways from the Allied Site to other drinking water receptors (wells). Existing general hydrogeologic and specific capture zone information prepared for and approved by MDEQ associated with the State of Michigan's Wellhead Protection Program was not even considered as an informational source or in the determination of potential off-site impacts from the contamination existing at the Allied Site.

This omission is inconsistent with MDEQ's intra-departmental advice for many reasons, including the following:

- The Michigan Wellhead Protection Program has existed since the 1986 Amendments to the Safe Drinking Water Act.
- The City of Kalamazoo Public Water Supply System (PWSS) is the second largest groundwater-based PWSS in the State of Michigan that over 120,000 people depend on for their drinking water source.
- No mention is made of existing private wells in the area of the Allied Site from which other people may derive their drinking water.
- The Allied Site is located within an MDEQ-approved 5-Year Time-of-Travel Capture Zone/Wellhead Protection Area (WHPA) for five municipal wellfields that include 26 Type I municipal wells. MDEQ defines a Wellhead Protection Area as "The surface and subsurface area surrounding a water well or wellfield, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield."

The Allied Site is listed in the MDEQ-approved Contaminant Source Inventory for the subject Wellhead Protection Area that by definition "might represent a threat to the public water supply system." Information presented in the RI does not support the dismissal of the possibility that contaminants existing at the Allied Site are reasonably likely to move toward the subject wellfields. In fact, available information/evidence generally supports that possibility. As stated in the MDEQ Interoffice Communication from Mr. Brant Fisher, Environmental Engineer Specialist to Mr. Paul Bucholtz, Project Manager also expresses these concerns, including but not limited to the following statements:

- "The possible migration of contaminants off site, or to depths deeper than those at which the ADS investigation was conducted, cannot be completely ruled out."
- "Little information at the ADS was collected for elevations below 740 ft AMSL…No information at the ASDS was obtained on the regional flow system in which city of Kalamazoo wells are completed."
- "The list of contaminants of concern (COC) at the ADS is extensive…" (detections of PCBs, VOCs, SVOCs, and inorganics).
- "Perhaps the greatest concern is the fact that there are exceedences for inorganics at the western property line. No sampling was conducted beyond the property line to insure there had been no migration of the inorganics off site."
- "…it is possible the subtle mounding of groundwater at the site may have pushed chemicals on a more northerly vector. As noted above, the presence of contaminants at unacceptably elevated levels on the north and west boundaries of the site make this a distinct possibility."

4.2. Overall Site Characterization

There currently is not enough information in the RI to adequately characterize the hydrologic or contaminant conditions at and in the vicinity of the site. As previously stated, we based our technical review on the available information provided in the RI report, focusing specifically on soil and groundwater data presented on the various logs and graphics, specifically the numerous geologic profiles and groundwater contour maps. We note that many of the soil boring and well logs included in the final RI report are marked "**DRAFT**", which may or may not affect interpretations of subsurface conditions depending on whether or not these logs were revised before finalized.

The need to further investigate site conditions so that adequate controls can be implemented to minimize the risk to off-site receptors cannot be ignored. Mr. Fisher, MDEQ, shares this concern in the previously referenced memo where he states, "It would be beneficial if additional information were collected to the north and west of the ADS." His recommendations included (a) groundwater sampling at shallow and at depth to insure that migration of contaminants has not occurred beyond the site; (b) collection of static water levels (SWLs) to confirm groundwater flow; (c) installation of sentinel wells to be screened to intercept the probable flow path(s) between the ADS and wells located at Water Pumping Stations 1 and 3; and (d)

groundwater flow modeling may be needed to identify the well depths most useful for the purpose of monitoring for contaminant migration.

In addition, leaving the contamination in an uncontrolled condition is contrary to the intention of a Wellhead Protection Plan that is defined as "An organized strategy to minimize known and potential risks within Wellhead Protection Areas." Additional data collected (e.g., monitoring wells and chemistry) would help define the relationship between the upper and lower water-bearing units within OU-1. Subsequently, more information could enhance the FS and lead to a more effective remedial solution.

Only selected information was used to support the assumption that Portage Creek is the discharge point for all of the groundwater beneath the site. For example, according to Cross-Section D-D', well construction tables, and well logs, MW-122B is the third deepest well at the site and is screened from 55.3-60.3 feet below ground level (748.5-743.5 feet MSL), significantly lower than MW-122A (797.9-781.9 feet MSL) and MW-122AR (794.7-784.7 feet MSL) at the same nested location. Appendix H, Figure H-1 (hydrograph) shows that the water level in MW-122B is consistently lower than the shallower wells at the same location, regardless whether the permanent sump PS-1 was operating or not. This information suggests that a downward potential exists at this location and could possibly provide a pathway for migration of contaminants off site.

MW-212 is also in the vicinity of MW-122B but is reportedly screened in the "Intermediate Sand" from 12.2-16.9 feet below ground level (774.6-769.9 feet MSL) – notably shallower. However, the water level in MW-212 is also lower than the shallower wells, possibly due to a connection to the lower sand unit via the sandy seam that is surrounded by till. This possibility is also supported by the groundwater flow model that was performed for the capture zone determinations that indicates a generally northerly flow at depth in the Allied Site area.

The heterogeneous nature of the materials at the Allied Site makes generalizations regarding groundwater flow difficult at best. The cross-sections illustrate the wide variety of materials and possible horizontal and vertical flow pathways and display very little consistency to base reasonable assumptions. That fact coupled with the extensive list of contaminant types and variable and elevated levels, artificial mounding effects, lack of efficient geochemistry evaluation, and lack of off-site monitoring, support that the site needs to be

accurately characterized, the deeper groundwater flow regime be studied, and measures to control the migration of the contaminants on site be implemented.

Erroneous conclusions are possible regarding OU-1 site characterization from samples that have a spatial bias of predominantly covering only one-third of the entire site. As emphasized in the RI report, several hundred samples of soil, groundwater, sediment, and other media, were collected analyzed or evaluated during the numerous site investigations conducted over the past 15 years.

The locations of most of the sampling points is presented in Figures 4, 5, 8, 35A, 36A, and 36B. What is most striking about the sample locations is their spatial distribution across OU-1. A majority, approximately two-thirds of all most recent sampling points are located along or within the former Bryant HRDL/FRDLs, even though this area occupies only about a one-third of the total area of OU-1.

The reason for the bias in sampling locations presented in the report is found in Sections 2.2 and 4.0. In summary, the report suggests that sufficient information was available to indicate that the other areas of the site (i.e., the Western Disposal Area (WDA), the former Type III Landfill, and the Monarch HRDL) were obviously impacted by residuals and *did not* require extensive investigation and would be dealt with during the FS to determine remedial actions, which will likely include presumptive remedies, such as consolidation and capping, completed at other OUs along the river.

The logic applied here is somewhat puzzling since the bulk of the residuals at OU-1 appear to be located in the HRDL/FRDLs due the excavation of the former Bryant Mill Pond where the characteristics of fill materials are fairly well known. Conversely, based on the operational history of the WDA, Type III landfill, and Monarch HRDL, combined with limited sampling, the subsurface conditions are less defined, which would warrant further investigation during the RI, not the FS phase, to guide the future studies and appropriate final remedial actions.

Furthermore, the activities that generated the former Type III landfill are far different from those that generated the HRDLs/FRDLs. This further suggests that the waste characteristics, along with the subsurface conditions, will be different from that encountered in the HRDLs and FRDLs.

From a purely technical perspective, it is widely known that subsurface conditions characterized by glacial deposits are typically heterogeneous, comprised of a wide range of soil types that form aquifers and aquicludes of varying dimensions. In other words, each site is unique. Accordingly, it is reasonable to approach the remedial investigation of each OU of the Kalamazoo River Superfund Site separately to determine how defined characteristics of residuals and similar materials interact with distinct hydrogeologic conditions, not vice-versa. The cross-sections effectively illustrate this point and support the likelihood that potential pathways exist through these subsurface materials via relatively permeable "windows" of geologic and other materials.

Again, we believe too few data points are available to accurately depict or interpret the hydrogeologic conditions of OU-1. The nature and extent of the residuals, as well as other fill materials in these three areas is, based on a relatively small set of borings and wells and warrants further investigation.

In general, based on the volume of information collected, we concur with the geologic interpretations in the areas of the HRDL and FRDLs presented in the RI, specifically because these locations were so intensively investigated. The RI identifies seven distinct geologic units, which include: fill, residuals, peat, sand and gravel, silt, clay, and till. These units are subdivided based on their hydrogeologic characteristics, principally transmisivity, into aquifers and aquitards. The identified primary aquifers include three sand units described as the upper, intermediate, and lower sand deposits. The deposits of fill, residuals, silt, clay, and till, where present, are considered aquitards. The peat, which ranges from fibrous to cohesive, is considered both aquifer and aquitard.

The upper sand aquifer is ubiquitous and underlies most areas of the site. The only exception is where this material has been excavated and backfilled, apparently as part of the USEPA/USACOE removal actions. In several areas, the intermediate aquifer is distinct and in others, particularly where aquicludes are not present, it is undifferentiated from either the overlying upper and underlying lower aquifers. The so-called lower aquifer, which is likely part of the regional flow regime that serves as the primary water supply for the City, was only encountered in a few borings/wells.

The residuals, which are the primary source of contamination, particularly PCBs, are present to varying degrees throughout OU-1, with the greatest volumes reported within the FRDLs/HDRL. Significant deposits of this soft, low-strength, compressible waste, are indicated on the geologic profiles within the Monarch HRDL, as well as portions of the WDA and the former Type III landfill. In several cases, the residuals lay directly above or within saturated permeable fill and native soils.

4.2.1 Groundwater Flow and Recharge

The series of groundwater flow maps presented in the RI, beginning in 1993 and through 2003, indicate that flow direction in the upper and intermediate aquifers is radial, controlled by the location of Portage Creek, the dominant local discharge feature in the area. Portage Creek enters the site at the southwest boundary, flows east, and then shifts to the north as it flows towards the Alcott Street dam. It ultimately discharges into the Kalamazoo River approximately 2.5 miles north of OU-1.

The groundwater elevations and flow patterns suggest that OU-1 is a "flow through" landfill site. More specifically, groundwater entering the site from the west encounters saturated, contaminated materials, including residuals, present below the water table until discharging to Portage Creek. As long as this condition persists, impacts to groundwater will continue until mitigated.

The groundwater flow pattern does not change appreciably between 1993 and 2003, suggesting that the IRM activities have had little impact on site hydrogeology. We note that the steep gradients (i.e., 0.13 ft/ft) and mounding observed between FRDL-1 and the creek did not dissipate following installation of the sheet pile wall, associated interior drainage features, and the composite cap. As in the past, an outward gradient persists between OU-1 and Portage Creek, which provides the potential for contamination migration off-site. The emphasis on data collection concentrated along the boundary of the FRDLs/HRDL precludes a detailed evaluation of subsurface flow within other areas of OU-1. Also, we note that groundwater flow maps after 1993 exclude the northern half of the site.

Recharge to the upper and intermediate aquifers is supplied by direct infiltration and off-site, upgradient flow. Of these two mechanisms, based on aquifer thickness and the relative size of OU-1 compared to the

upland areas to the west, the latter is the primary recharge source to the Allied site. The capping of the FRDLs and HRDL has little impact on recharge, groundwater elevations, or the prevailing flow direction.

Consolidation water from the residuals is likely a source of recharge to the underlying and adjacent aquifers. These materials are characterized by weak compressive strength and moisture content as great as 100 percent. The residuals are also highly compressive. As a result, the residuals will consolidate in response to its own, or external loading, which causes pore water pressure to increase and an associated migration of fluid from the residuals toward prefer drainage paths. In this case, the consolidation water will flow to adjacent or underlying permeable granular deposits. This process will continue until the residuals fully consolidate under the applied load. This phenomenon not only contributes to recharge, but has obvious implications related to groundwater quality.

4.2.2 Flow Nets

The RI presents a series of flow nets (Figures 29 through 34) on selected geologic profiles. These diagrams are normally constructed to provide a conceptual, two-dimensional view of groundwater flow. The vertical equipotential lines are nearly vertical in zones of high conductivity, indicating primarily horizontal flow, and refract and flatten in less permeable deposits, suggesting a stronger vertical flow component.

In general, the flow nets confirm the observations discussed above. Specifically, groundwater flows in the upper and intermediate zones from topographic highs toward local drainage features and ultimately to Portage Creek. The vertical gradients follow a similar trend, shifting from downward in the west and center portions of the site to upward as groundwater flows toward the creek.

It is interesting to note that flow nets were not developed for the deeper transmissive zones, particularly in the areas of MW-122AR/122B, where groundwater is mounding and downward gradients exist, as discussed further below. Such an analysis would be useful to determine if deeper groundwater, which serves as the primary water supply for the City, flows beneath Portage Creek and towards the supply wells located only 0.5 miles north of OU-1.

4.2.3 Relationship between Upper and Lower Transmissive Deposits

The relationship between the upper and lower aquifers, referred as 'transmissive deposits" in the RI report is partially demonstrated from water level observations near the northeast corner of FDRL-1. Specifically, the water levels in a well pair consisting of MW-122AR and 122B, which screen the upper and lower aquifer zones, respectively, suggest a downward flow potential.

As shown on Figure H-1, the hydrograph of MW-122B, which is screened from 748.5-743.5 feet MSL, shows water levels fluctuating between elevations 787 and 789 feet MSL throughout the period of record (1993 to 2006). In comparison, at Well MW-122AR, with a screened interval of 794.7-784.7 feet MSL, the water levels fluctuate between elevation 788 and 790 feet MSL. The water level at this well is consistently at a higher elevation than at MW-122B, which is a demonstration of a downward vertical gradient between these two transmissive zones.

MW-122AR and MW-122B are located inside the sheet pile wall, immediately east of FDRL-1 and near SG-1 installed in Portage Creek. As previously discussed, the nearly 13 feet of head difference between the latter two features create the mounding and steep horizontal gradients in this area. The groundwater elevation in FDRL-1 is typically greater than 792 feet MSL.

The mounding affect observed in this area, as well as the difference in water levels in FRDL-1 and the downward vertical gradients observed between MW-122AR and MW-122B is likely not a coincidence. It appears the groundwater mound serves as a recharge source to the underlying aquifer(s). This has potential implications on contaminant migration from source material to both Portage Creek and the deep aquifer that serves as the City's water supply.

We note that neither 122A nor 122B were ever used in the construction of the various water table elevation or piezometric surface maps, or flow nets, published in the RI report. This omission supports the City's concerns relative to the threat to the water supply and is repeated throughout the report, particularly with respect to selection of wells that reinforce an inherent bias towards a predetermined conclusion. This approach is not only admittedly biased, but disturbing since other conclusions may also have been made

with selective information and could jeopardize the intent of the RI to characterize site conditions, determine the nature of the waste, and assess risk to human health and the environment.

4.2.4 Groundwater Seeps

Groundwater seeps occur across OU-1 and were noted before and after the Removal Action and IRM activities. The persistence of the seeps after the installation of the sheet pile wall and internal drainage system along and within the HRDL/FDRLs is disconcerting. The RI postulates that the seeps are created in areas where the underlying aquifer is under sufficient pressure to migrate upward along a preferred flow path to the ground surface. This would suggest that base of the sheet pile does not fully penetrate the underlying aquifer into an aquitard, which should cut-off the source of groundwater to the seeps. Further, the mounding of groundwater behind the wall likely creates hydraulic conditions conducive to seep development.

As discussed in the RI report, there is on-going erosion at the locations of most of the seeps. The resulting flow provides a transport mechanism for various contaminants, particularly PCBs, which tend to adsorb to fine grained sediments or travel in colloidal form. The seeps flow overland toward local drainage features and ultimately to Portage Creek.

It is difficult to ascertain the pre- and post IRM conditions relative to the location and number, and water quality of seeps. As shown on Figure 36A and 36B, the number and location of seeps before and after site remedial efforts vary widely. It appears that the total number of seeps, especially along the perimeter of HRDL/FRDLs increased, likely due to the loading of the residuals with material excavated from the former Bryant Mill Pond. The loading of the soft, compressible residuals increased the effective stress, pore water migration, and resultant seeps.

Irrespective of the cause or source, the seeps pose an immediate threat to the environment as well has human health and safety and should be mitigated as part of the final action plan, or sooner, if possible.

5.0 SHEET PILE WALL AND GROUNDWATER COLLECTION SYSTEM

For reference, we summarize the design features of the sheet pile wall and interior groundwater/leachate collection systems separately below. We incorporate this information in our assessment of the overall system performance in subsequent sections.

5.1 Sheet Pile Wall

We note that our interpretation of the sheet pile penetration depth and foundation soil types is quite different than that provided in the RI report. However, we completely agree with the conclusions in the RI report (i.e., Section 6) that the existing barrier wall/groundwater collection system provides ineffective environmental protection at best.

The sheet pile wall was apparently first installed to address stability and erosion concerns following the placement of materials excavated from the former Bryant Mill pond in the HRDL/FRDLS. The mill pond spoils included both stream sediments and a considerable amount of residuals deposited in during the operation of the paper mill. Placing this spoil on top of the existing soft, compressible residuals in the former settling lagoon created an unstable condition that could have resulted in failure within the waste and/or the surrounding containment berms. The sheet pile is also intended to minimize off-site migration of eroded cover materials prior to maturation of the cap vegetation.

The sheet pile wall, constructed using corrugated, heavy gauge steel, has a total length of 2600 feet that extends from the southwest corner of the HDRL to the middle of the north boundary of FRDL-2. The wall does not enclose the entire area of the HRDL/FRDLs. The void created at seams of adjoining panels is reportedly filled with hydrated bentonite to create a "watertight" seal. The description and details of the sheet piles presented in Appendix F of the RI Report do not indicate whether any particular measures were implemented to provide corrosion resistance for the steel sheet piles.

The base elevation of the sheet pile, as shown on Profile D-D' (Figure 18), ranges between approximately 762 and 782 feet MSL. The type of soil at the base of the sheet pile also varies along its length from granular to cohesive. The southern segment and approximately half the eastern section of the wall are terminated

primarily in granular soils whereas the balance of the east wall, as well the north section, is founded in predominately cohesive soil. The base of the sheet pile wall is well below the local water table in all locations.

We note that our interpretation of the sheet pile penetration depth and foundation soil types is quite different than that provided in the RI report, which indicates *only* 600 feet of the sheet pile, in the southwest area of the Bryant HRDL, is *not* founded in cohesive soil. Our interpretation is based on our evaluation of Geologic Cross Section D-D', as well as perpendicular profiles, that clearly indicate that the sheet pile terminates in predominately granular, saturated soil in many areas of the site. Although we are unable to explain the difference between interpretations (both were determined using the same available data), it is clear that wherever the wall terminates in granular soils there are potential implications regarding groundwater quality outside the wall, as well as surface water in Portage Creek.

5.2 Groundwater/Leachate Collection System Summary

The existing groundwater/leachate collection system evolved over time and presently consists of a series of five extraction wells (GWE-1 through GW-5), ten permanent sumps (PS-1 through PS-10), as well a series of drainage trenches and an interceptor trench. This system was constructed to reduce the development of excess head behind the sheet pile wall and minimize off-site migration towards Portage Creek.

Figure 3, "IRM Activities Completed After USEPA Removal Action," shows that PS-1 through PS-4, (located inside the sheet pile wall beginning at the northeast corner of FRDL-2 and extending to mid-point of the south boundary of the Bryant HRDL) are connected via a drainage trench installed in 2000. SP-6 through PS-8, as well as PS-10, located along the south boundary of the HRDL, is not interconnected. A 100-foot long drainage trench, installed in 2003, extends west from PS-9. The invert elevations of the permanent sumps generally range between elevations 780 ft. to 790 feet MSL.

Extraction wells GWE-1 though GWE-5 are located inside the sheet pile wall, generally equally spaced, beginning at the northwest terminus of the wall near FRDL-2 and extending south and west around the HRDL to near the boundary of the WDA. The wells are not connected to long lateral collection drains, which would improve overall collection, their radius of influence and collection efficiency.

The extraction wells, as well as the balance of the other groundwater/leachate collection system features are connected to a lift station (MS-100) near FRDL-1 and treated with activated carbon. The pretreated water is ultimately sent to the Kalamazoo wastewater treatment plant (a.k.a. POTW).

5.3 Sheet Pile Wall/Groundwater Collection System Performance

We assessed the performance of the groundwater/leachate barrier and collection systems based on three criteria: 1) the so-called "1foot criterion," 2) published groundwater elevation and flow maps, 3) occurrences of groundwater seeps, and to a lesser extent, 4) annual flows from the collection system discharged to the POTW. Again, our assessment is based on data obtained directly from the RI report.

5.3.1 The "1 foot criterion" – The MDEQ, EPA, and the PRP consultant group developed a criterion to judge the performance of the barrier/collection system that required groundwater/leachate levels within the HRDL/FRDLs, and inside the barrier wall, to be within 1 foot of historical levels observed prior to the implementation of the IRM. Although never stated explicitly in the body of the report, the rule is intended to maintain long-term water levels *below* 1 foot of historical highs across the area enclosed by the partial containment system in order to minimize hydraulic head build-up, mounding, and off-site groundwater migration through, beneath, or around the barrier wall.

We question the basis and applicability of the 1 foot criterion at this facility. Historically, prior to any IRM, groundwater levels away from Portage Creek are always greater than the surface water elevation (i.e., water flows toward the creek). As discussed previously, the site is characterized as a 'flow-through" landfill where groundwater flowing from the western uplands migrates to site flowing through the waste to the east and then radially to the north and south, providing a contaminant transport mechanism to the creek.

Maintaining a 1-foot positive head behind the wall reduces, but does not completely mitigate the potential for off-site groundwater flow beneath, around, or through the sheet pile barrier. This goal can only be achieved by reducing water levels behind the wall *below* historic, pre-IRM conditions, which would create *inward gradients* and provide the associated environmental protection benefits.

Nevertheless, both BBL (the PRP primary consultant) and CDM (MDEQ's consultant) spent an inordinate amount of time justifying the applicability and measurement of this performance standard, using different statistical approaches. In fact, large portions of two appendices (Appendix G and Appendix S) are dedicated to this issue.

In the end, neither approach results in 100 percent achievement of the criterion. BBL's approach, using a subset of selected wells, results in one well, OW-6P, exceeding the 1-foot rule after 2003 and the CDM approach results in up to 25 exceedences in nine wells through 2006. In both cases, the wells exceeding the 1 foot criterion are located near the south portion of the OU and the southeast corner of the WDA, indicating the containment system is not effective in these areas of the site.

We note that an inward gradient is currently being achieved in at least one area of the site, near GWE-4, located inside the sheet pile. As shown on Figures 26 and 28, the potentiometric surface of the shallow aquifer near this pumping well is at or below the surface water elevation of Portage Creek. The tip elevation of GWE-4 is approximately 782 feet MSL. Groundwater elevations at this location were about 789 feet and 786 feet MSL and the estimated surface water elevation ranges between 786 feet and 782 feet MSL, respectively at the time measurements were collected. This suggests future improvements, if properly designed, could create inward horizontal gradients elsewhere across the site.

5.3.2 Groundwater Elevation, Flow, and Seeps – The various groundwater flow maps and hydrographs published in the RI report between 1993 and 2003 provide another measure of the effectiveness of the sheet pile/groundwater barrier system. As previously discussed, the pattern of groundwater flow prior to and after the installation of the wall and collection system do not change appreciably over the 10 year period of record, which intuitively suggest these barriers have little impact on the hyrdrogeological regime. The exceptions include the change in the pattern of hydraulic headlines near the north and south termination of the sheet pile wall that deflect to the east, suggesting groundwater flow around the wall toward Portage Creek.

An assessment of the hydrographs presented in Appendix H, reveals most wells behind the barrier rose abruptly after its installation and slowly dissipated over time. The RI report attributes the rise and

subsequent fall of water levels as a demonstration that the barrier/collection system is effective and performing as designed. An alternate interpretation is that the following installation, after the initial rise in groundwater levels, the head build up increased the flow through, around, and beneath the barrier until reaching a steady state, close to the pre-existing conditions. The latter interpretation suggests that the barrier is ineffective and does not perform as designed.

The occurrence of seeps is yet another potential measure of the barrier system performance. According to the RI report, seeps are present both inside and outside the wall and occur when the underlying aquifer is under sufficient pressure to force groundwater upward to the surface along preferred pathways. As previously discussed, if the base of the sheet pile wall is set in low-permeability, cohesive soil it should cut-off the groundwater supply inside and prevent seep development outside the barrier. In this case, where seeps occur is a potential indication the barrier is either not seated in cohesive soil or not performing as designed. Conversely, if seeps develop inside the wall, it may indicate underflow is prevented, but the collection system is not properly designed or functioning sufficiently to prevent hydraulic build-up.

5.3.3 POTW Discharge Records – Annual flows from the groundwater recovery system between 1999 and 2005 are presented in Section 3 of the RI Report. Prior to 1999, the collection system consisted of just five extraction wells and five temporary sumps. In 1999 the total site discharge to the POTW was approximately 0.5 million gallons and increased to almost 3.4 million gallons later that year. In 2000, the addition of five additional temporary sumps (TS-6 through TS-10), as well as the replacement of two extraction wells, increased the annual flow to approximately 12 million gallons.

Interestingly, the total annual volumes discharged to the POTW *decreased* following the installation of additional drainage features, including an interceptor trench along the boundary of FRDL-1 and FRDL-2 in 2002, and a lateral collection trench connected to PS-9 in 2003. By 2004 the total flow dropped to about 8 million gallons and to just 6 million gallons in 2006.

The RI report attributes the decrease in annual flow to the decrease in recharge via infiltration following completion of the final cover system in 2004, which may or may not be the case. As indicated previously, the area of the final cap is only 22 acres whereas the area upland contributing to horizontal recharge is

much greater. Also, there is no discussion of historical pumping problems that would result in temporal flow variation.

We note that although the total annual flow in 2006 is more than six times greater than in 1999 the water levels at and the area of the site are essentially the same, indicating the total volume of groundwater within the monitored areas of OU-1 has not changed appreciably in spite of site improvements. It would be useful to compare the results of a water balance analysis before and after the IRM activities to further establish the factors controlling aquifer recharge, water levels, and to establish appropriate pumping rates to achieve groundwater elevation criteria revised to maintain inward gradients.

6.0 GEOTECHNICAL IMPLICATIONS OF PCB CONTAMINATED RESIDUALS IN OU-1

As discussed previously, the paper waste residuals within OU-1 possess unique geotechnical characteristics that have implications for not only future remedial actions, but also potential site redevelopment, which is one of the City's goals for this property. Once again, the residuals are characterized by cohesive texture, high moisture content, and very low compressive strength.

These properties posed both geotechnical and environmental challenges. First, because of its low internal strength, excessive loading of the residuals can create unstable conditions and potential catastrophic slope failure, which was the main reason the sheet pile was installed along the down slope edge of the Bryant HRDL/FDRLs. The second problem relates to the potential environmental impacts related to consolidation.

For reference, the consolidation of residuals is a function of the boundary conditions, the drainage path distance, and the strength of the chemical bonding between the waste and entrapped water. From a microscopic level, the structure of the residuals likely consists of a series of silica sheets with water molecules located between silica layers. Different types of mineralogy affect the affinity for water and determine the behavior of the residuals.

The high moisture content of the residuals, which can exceed 100 percent, indicates free or unbound water exists in the waste mass. In this condition, waste will consolidate under its own weight or additional loading. The excess water must migrate from the soil to allow the soil skeleton to compress.

PCBs present in the matrix of the residuals and in the pore water are likely released as the material compresses. This process will continue as long as a load is imposed or consolidation is complete. The time frame that this process occurs is dependent on the permeability of the residuals and the length of the drainage path. In OU-1, the unconsolidated hydraulic conductivity is reportedly low (e.g., 1×10^{-7} cm/sec, or less) and the drainage path varies in length depending on dimensions of the residual mass and the proximity of adjacent and underlying granular soils.

We note that the Removal Action completed in 1999 by the USACOE that included placing sediment and residuals excavated from the former Bryant Mill Pond into and atop the residuals within the HRDL/FRDLs, likely increased the rate of consolidation and probably exacerbated environmental impact to underlying aquifer(s) as PCB-contaminated pore water was expelled and migrated laterally and vertically to the transmissive zones. The load applied from the final cover probably also increased the rate of consolidation.

Controlling the rate of consolidation and mitigation associated environmental impacts should be considered as part of future remedial activities. Wick drains are the traditional geotechnical method to control the rate of consolidation in soft, saturated cohesive soils. In recent years, wick drains have been applied in several environmental applications to collect contaminated water and control lateral gas migration.

Wick drain systems typically consists of geotextile strips, or "wicks" driven into and along the boundaries, of soft, saturated, cohesive, or semi-cohesive material using a mandrel that drives the wick into soil at predetermined depths and spacing to create a "wick wall." The wicks work by capillary force that "wicks' collected water to a preferred drainage path, which can be a permeable soil deposit or collection pipe. As the material consolidates, the soil skeleton compresses, and strength increases.

A wick drain system may prove useful at OU-1 as part of the both future remedial actions to control the release of PCBs resulting from waste consolidation and final cover placement. The wick drain system might

also be useful to improve the strength of underlying deposits that may provide expanded redevelopment options for the site.

7.0 WASTE RESIDUALS AS LANDFILL LINER/COVER MATERIAL

Section 3.2.5.3 of the RI report discusses the potential application of paper waste residuals as landfill base and cover liner material, citing the results of hydraulic conductivity testing published in three professional papers suggesting the material is suitable for landfill barrier construction. The report also includes the results of a hydraulic conductivity testing program completed by BBL that included residual samples from the Bryant HRLD and FRDLs, which yielded similar results based on a geometric mean of ten tests.

BBL reports that these results are "significant" especially in light of the placement of the 146,000 cubic yards placed in the HRDL/FDRLs during the USEPA Removal Action and subsequent cap that increased the effective stress in the underlying residuals that caused the material to dewater and consolidate, thereby reducing hydraulic conductivity. There is no discussion of the fate of the PCB-contaminated pore water displaced by this process.

With respect to using residuals as a cover material, there is also no discussion of the stability concerns related to placing saturated weak material on any type of slope or the threat to health and safety associated with intentionally placing contaminated material in close proximity to ground surface. The discussions with respect to using the residuals as a component of a final cover system are academic, with no reference to practical concerns, such as placement, compaction and constructability.

We are very concerned that this information was included in the final version of the report, particularly since it was published under the auspices of the MDEQ and USEPA. The implied proposal, even to the casual reader, is that the contaminated residuals, which lie below the water table and are the source of groundwater contamination, will be part of a presumptive remedy for OU-1. Clearly, for the protection of all involved, we trust that regulatory agencies will not advocate use of the Allied Paper waste residuals in any part of the design of the final remedial action for OU-1.

8.0 ADDITIONAL CONSIDERATIONS FOR THE FEASIBILITY STUDY

Looking ahead, we believe it useful, even at this preliminary stage, to review the potential relevant and applicable State rules and regulations with respect to PCB waste disposal as the project enters the FS stage. Specifically, we believe a cursory review of Michigan's PA 451 of 1994 Part 111, the Hazardous Waste Management Rules, is appropriate to guide the FS and any presumptive remedy for OU-1. In addition, based on the MDEQ and EPA mandated improvements and final remedial action plans elsewhere in Michigan, we provide our suggestions for improving the performance of the existing IRM features that should be considered as part of the FS to be consistent with both State and Federal environmental protection standards.

8.1 Existing Michigan Hazardous Waste Rules and TSCA Landfill Design Criteria at WDI Site No. 2.

According to Part 111, Rule 299.9620, the based liner system should incorporate the following minimum requirements: a double composite system including, from top down: (1) a 80-mil textured high-density polyethylene (HDPE) primary geomembrane; (2) a primary 5-foot compacted clay liner with a maximum hydraulic conductivity of 1×10^{-7} cm/sec; (3) a leak detection system consisting of a double-bonded geocomposite, which consists of a geonet sandwiched between, and heat bonded to, non-woven needle-punched geotextiles, (4) a 80-mil textured HDPE secondary geomembrane; and (5) a secondary 3-foot compacted clay liner with a maximum hydraulic conductivity of 1×10^{-7} cm/sec. Equivalent layers of geosynthetic clay liners (GCLs) can be substituted for the compacted clay, as appropriate.

Further, the bottom of the double composite liner system must maintain a minimum vertical groundwater isolation distance of at least 10 feet above the historical groundwater elevation or above the base of an underlying confining layer. Defined horizontal isolation distances, with respect to surface water bodies, wetlands, residences, and Type I, II, and III water supply wells also apply.

The proposed final cover liner system, meeting the requirements of Rule 299.9619(6), must consists of the following components from top down: (1) a 6-inch vegetative growth layer: (2) a 24-inch protective soil layer; (3) a drainage geocomposite layer with a minimum transmisivity of 7×10^{-5} m2/sec., (4) a 40-

mil geomembrane liner; (5) a geosynthetic clay liner (GCL) or 5-foot thick compacted clay layer with a demonstrated hydraulic conductivity of 1.0×10^{-7} cm/sec, and (6) a 12-in leveling layer above the waste.

The conditions existing at OU-1 violate nearly all design criteria and isolation distances required by the existing rules and regulations. We note that the standards outlined above are the minimum requirements at the EQ-WDI Site No. 2 TSCA disposal facility in Van Buren Township, Wayne County, Michigan, that has and continues to accept PCB wastes in excess of 50 parts per million (ppm) from the Plainwell OU resulting from ongoing remedial activities at that site.

Logically, if the criteria imposed by both State and Federal rules and regulations at active, commercial TSCA-licensed disposal facilities represent minimum acceptable standards, the same should apply at OU-1, particularly based on the unique geographic and demographic setting in this area of Kalamazoo, which includes hundreds of surrounding private residences and businesses. These factors should be the primary focus of the FS and any subsequent final remedial action.

8.2 Meeting Minimum Standards & Improving OU-1 IRM Existing Features

To address the various apparent deficiencies associated with the IRMs at OU-1 identified above, several modifications are necessary to improve the existing containment system and provide enhanced environmental protection, especially with regard the underlying deep aquifer used as the City water supply, Portage Creek, as well as the surrounding residents, and businesses.

Based on knowledge of requirements imposed by MDEQ and EPA at other, similar facilities in Michigan, we propose the following improvements to optimize environmental protection as part of the FS for the Allied Paper site.

- Totally encompass OU-1 with a cut-off wall constructed of impermeable materials (e.g., soil-bentonite) to minimize upstream recharge and downgradient discharge to Portage Creek.

- Install additional drainage features within the HRDL/FRDLs and in other areas of OU-1 to create inward gradients site-wide.

- Consolidate waste from the other disposal areas in OU-1 to minimize the waste footprint.

- Regrade and cap site with composite cover to promote runoff and minimize infiltration.

- Develop a performance monitoring program with interior and exterior wells (i.e., directly inside and outside the sheetpile wall), including nested sets in the shallow, intermediate, and deep aquifers at each location. Also establish a long-term groundwater monitoring program that will include a defined monitoring network, constituent list, monitoring frequency, sampling and analysis protocol, and determination of contingency plan (below) action levels.

- Install a series of sentinel wells along the primary flow path of the deep aquifer. Further, prepare a contingency plan to address corrective actions should groundwater monitoring action levels be reached indicating potential impacts to the deep aquifer that provides the City water supply.

Short of complete removal of the all wastes and PCB-contaminated residuals in the disposal areas desired by most residents, which would mitigate the source and future contamination, the proposed improvements are reasonable given the unique demographics associated with OU-1 as compared to OU-2, 3, & 4. Each of these features and improvements should be considered as part of the FS and remediation alternatives analysis, as discussed in above.

9.0 CONCLUSIONS AND RECOMMENDATIONS

The City of Kalamazoo, along with their consultants, has completed their review of the MDEQ's "Allied Paper, Inc. Operable Unit Remedial Investigation (RI) Report, dated March 2008, which includes over 9,500 pages of text and data. Based on our technical review, analysis, and evaluations, we offer the following conclusions and recommendations for consideration as the project moves forward into the Feasibility Study (FS), Record of Decision, and subsequent Remedial Design/Remedial Action phases.

- The RI report is based on what appears to be a biased sample data set, focusing on the performance of information collected in only approximately one-third of the total site in the area of the former Bryant HRDL/FDRLs. Consequently, the balance of OU-1, which occupies nearly two-thirds of the total

site, is largely and scientifically uncharacterized. Additional information is required in these other areas, including the Former Type III landfill, Western Disposal Area, prior to completion of the FS and Remedial Design. The existing final RI report, which includes "draft" figures and documents, should be used as a basis for developing a Phase II RI, to address the published omissions, bias, and conclusions in the "final" report, prior to implementing the FS. Kalamazoo should be consulted in every phase of additional investigation, prior to implementation, as well as in the interpretation of subsequent results.

- The RI focus appears have evolved from an originally proposed complete review of OU-1 to only the performance of the Bryant Mill Pond TCRA implemented along the downgradient areas of HRDL/FRDLs that cover a mere 22 acres of the nearly 90-acre OU-1, which were initially implemented to prevent catastrophic failure of the waste placed during the USACOE Removal Action. For reasons not explained, the balance of the site evaluations and final RI report findings shifted and focus was placed on this limited area of the site at the expense of an overall approach of OU-1 and the potential threat to the City water supply and continuing adverse impacts to Portage Creek. More input from qualified committees representing the City, County, and citizen action committees is essential to develop conclusions and recommendations that are more meaningful.

- The potential threat to the City's Type I Public Water Supply System is virtually ignored in the RI, in spite of legitimate concerns raised by the MDEQ's Water Bureau Chief Engineer, who was never consulted during the RI process; clear lines of communication between intra-government must be included moving forward. Kalamazoo's Wellhead Protection Program (WHPP), which is designed to protect over 120,000 users, is not addressed and the MDEQ-approved groundwater modeling/capture zone delineations and other documents associated with the WHPP were not even considered and/or reviewed. OU-1 is located in the MDEQ-approved 5-year Time-of-Travel Capture Zone for five of the City's primary water supply wellfields consisting of 26 wells that are located only 0.5 miles north of the site. Involvement of the City, particularly, its Environmental Services staff in planning future investigations is essential to address this important issue.

- OU-1 is characteristic of a "flow-through" landfill with groundwater flowing from the western uplands through the site, contacting contaminants, including PCB residuals along the flow paths, and then

migrating predominately radially towards Portage Creek. The observed flow groundwater patterns vary only slightly prior to and after the IRM activities, suggesting OU-1 is still impacting the creek, and possibly, deeper zones used as the City water supply. The groundwater levels within the HRDL/FRMLs are essentially the same after the IRM activities, suggesting the flow patterns, total water volume, and hydraulic heads have not significantly changed and capping of the former HRDL/FRDLs appears to have little impact on recharge or reduction of environmental impacts.

- The use of selected sampling locations, particularly points that clearly demonstrate a predetermined conclusion, omit acknowledgement of the clear downward gradients at certain monitoring locations that pose a potential threat to deeper aquifers within OU-1. This apparent intentional avoidance of available data casts doubt on the bases used to develop the RI report and conclusions.

- The use of the apparently arbitrary "1 foot" criterion with respect to a demonstration of the effectiveness of the barrier wall/collection system results in outward horizontal gradients that continue to adversely impact the quality of Portage Creek – as evidenced by the screening criteria being exceeded by multiple contaminants - and potentially impacting the deeper water-bearing zones. The existing barrier wall/groundwater collection system provides ineffective environmental protection at best.

Contaminated groundwater apparently flows through, around, and beneath the sheet pile wall. Further, the stabilization of groundwater elevations to pre-IRM activities, has only restored outward horizontal gradients, and possibly induced a downward gradient, that continues to impact groundwater and surface water. Also, the ongoing occurrence of surface groundwater/surface water seeps, further demonstrates the ineffectiveness of the containment system. Section 6-3 of the RI openly discusses the ineffectiveness of the system to prevent the contaminants from migrating off-site or even to meet the required goal of keeping groundwater levels to within one foot of the historic groundwater level.

- The current selected "piece-meal" or "patterned" approach by MDEQ and EPA Region V apparently represents the foundation of the "presumptive remedy" for the final remedial action at Allied Paper, and unfortunately is "consistent" with their solutions for the other three landfill OUs. This bias seems

based on the misguided conclusion that information from other landfill OUs is sufficient to develop presumptive remedies at OU-1 without further investigation. This ignores the unique subsurface conditions that occur in heterogeneous glacial deposits at OU-1, as well as other areas. An unbiased, qualified third party should oversee and arbitrate all future actions relative to OU-1.

- Prior to the FS, a series of "sentinel wells" need to be located at appropriate depths within the flow path of Kalamazoo's Water Pumping Stations/Wellfields 1 and 3, located approximately ½ mile from OU-1. Further, a contingency plan is needed in the event the City's water supply is impacted by a release from their site. This should include, at a minimum, immediate remedial action, increased monitoring, as well as plans to provide a secure, reliable source of potable water to affected individuals. And finally, a long-term ground water monitoring program should be developed that will include a defined monitoring network, constituent list, monitoring frequency, sampling and analysis protocol, and determination of the aforementioned contingency plan action levels.

- The waste residuals are characterized as soft, weak, saturated, contaminated, and compressible, that consolidates under their own weight and further by external loading. The excess pore water expelled by loading the materials in the HRDL/FDRLs during the USACOE in 1999 likely exacerbated this process as well groundwater degradation to underlying and adjacent aquifers. The subsequent load associated with capping this area likely further dewatered the residuals, adding to potential groundwater contamination. The traditional geotechnical tool "wick drains" might prove useful to control and mitigate contaminant transport as part of future site improvements, as well as increasing the strength of underlying fills to increase redevelopment opportunities.

- The argument supporting the use of PCB-contaminated residual materials as a liner component of the Remedial Design is indefensible. Use of PCB-contaminated residuals particularly as a vertical barrier or in a final cover, is scientifically unacceptable due to its tendency to decrease in hydraulic conductivity with loading, expelling contaminated in the process. Indeed, if this was proposed to the USEPA by an independent party at another site, it would not seriously be considered. We are very surprised this concept was included in the final RI report for OU-1 that was reviewed, accepted and published under the auspices of our trusted regulatory agencies, the MDEQ and USEPA.

- The current interim remedial measures taken during the Bryant Mill Pond Emergency Removal Action are insufficient to mitigate on-going or future contaminant migration and associated groundwater, surface water, biological, and associated environmental impacts. Short of complete removal and restoration of waste materials, or immobilization, a complete enclosure of the entire site with a hydraulic barrier, consisting of a vertical soil-bentonite wall, keyed into an impermeable layer, coupled with improved groundwater/leachate collection to create inward gradients, is the preferred final remedial action for OU-1.

This plan should also include waste consolidation to reduce the overall waste footprint, regrading and total capping with a composite impermeable cover system. Further, a monitoring system, with wells set in all water-bearing zones, inside and outside the barrier wall, and tested on a quarterly basis for all parameters identified in the waste, should also be the focus of the FS and final remedial design. All groundwater seeps should be identified and remediated immediately. Similar remedial, final closure designs have been mandated by MDEQ/USEPA at similar sites throughout Michigan and Region V.

- The conditions existing at OU-1 violate nearly all design criteria and isolation distances required by the Michigan's PA 451, Part 111 existing rules and regulations relating to hazardous disposal. We note that the standards outlined above are the minimum requirements at the EQ-WDI Site No. 2 TSCA disposal facility in Van Buren Township, Wayne County, Michigan, that has and continues to accept PCB wastes in excess of 50 ppm from the Plainwell OU resulting from ongoing remedial activities at that site.

If the criteria imposed by both State and Federal rules and regulations at active, commercial TSCA-licensed disposal facilities represent minimum acceptable standards, the same should apply at OU-1, particularly based on the unique geographic and demographic setting in this area of Kalamazoo, which includes hundreds of surrounding private residences and businesses. These factors should be the primary focus of the FS and any subsequent final remedial action.